6,297,936), claims 1-3 are rejected under 35 U.S.C. § 102(e) as being anticipated by Hawwa et al. (U.S. Patent No. 6,108,175), claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Kant et al. in view of Fan et al. (U.S. Patent No. 5,364,742), and claims 7-11 and 14-17 are objected to.

The present application recites an actuation system including an actuator arm, a suspension, a flexure, and a slider (shown in FIG. 1 below). The present invention is a microactuation system for use in a dual-stage disc drive actuation system for high resolution positioning of a transducing head. The microactuation system is comprised of a bending motor attached between a section of a load beam and the flexure (shown in FIG. 3 below), which are both components of the suspension. The bending motor is mounted to a top surface of a flexible beam connected between the load beam and the flexure.

Independent claim 2 of the present application recites a microactuator for selectively altering a position of a transducing head carried by a slider in a disc drive system with respect to a track of a rotatable disc having a plurality of concentric tracks. The microactuator comprises a load beam attached to a distal end of an actuator arm, the load beam having a first section. A bending motor is attached between the first section of the load beam and the flexure, the bending motor being deformable in response to a control signal applied thereto. A flexible beam is connected between the first section of the load beam and the flexure, wherein the bending motor is attached to the flexible beam.

Independent claim 13 of the present application recites a disc drive suspension. The disc drive suspension includes an actuator arm having a proximal end and a distal end. A load beam is attached to the distal end of the actuator arm. The load beam has a mounting region at a proximal end, a head suspension near a distal end of the load beam, and a flexible region between the mounting region and the head suspension. A flexure is configured to support a transducing head. A beam is connected between the head suspension and the flexure. A bending motor is attached to a top surface of the beam such that the beam supports the bending motor and transforms a force on

the flexure into a compressive load on the bending motor, the bending motor being deformable in response to a control signal applied thereto.

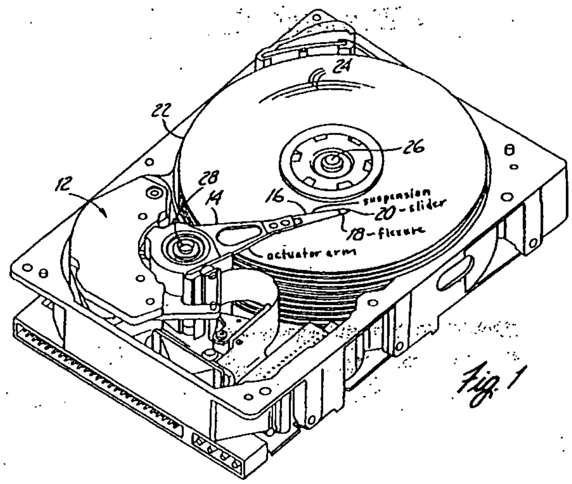

Fig. 1

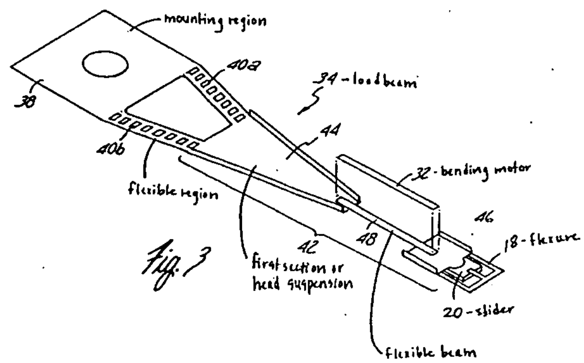

Fig. 3

Claim rejections-35 U.S.C. § 102(e)

Claims 2-6 and 13 are rejected under §102(e) as being anticipated by Kant et al. Kant et al. discloses a disc drive including a microactuator to finely position a transducing head adjacent to a selected track of a rotatable disc, as shown in FIGS. 2, 4 and 5 below. The disc drive includes an actuator arm, a load beam attached to the actuator arm, a flexure attached to a deflectable portion of the load beam and a slider supported by the flexure proximate the surface of the rotatable disc. The disc drive includes a microactuator integrally formed in the load beam, the microactuator being operable to deflect the deflectable portion of the load beam to finely position the flexure and the slider carrying the transducing head adjacent to the selective track of the rotatable disc.

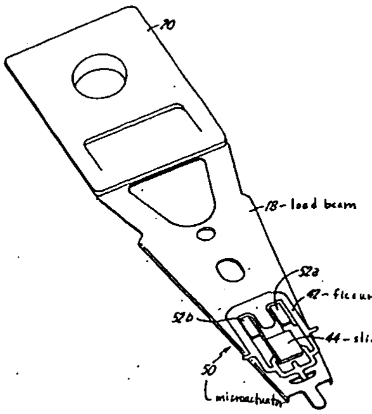

FIG. 2

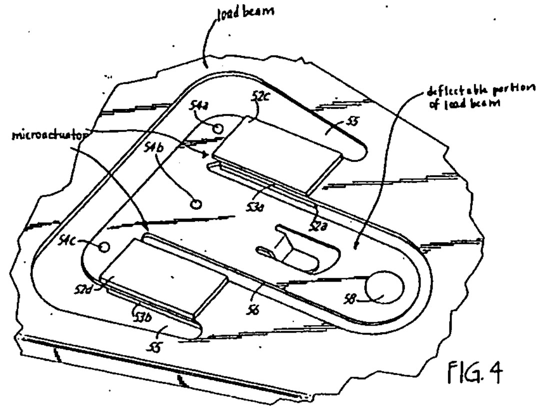

FIG. 4

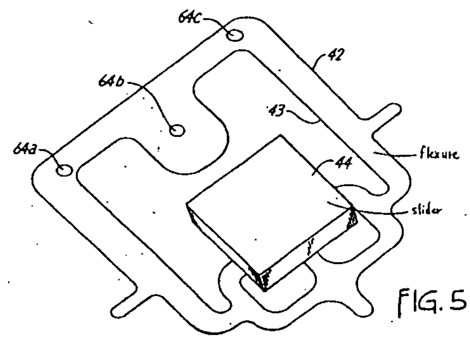

FIG. 5

In Kant et al., the deflectable portion of the load beam is comprised of outer panels 53a and 53b and a center panel 56 formed in the load beam (col. 3, lines 19-20). The outer panels 53a, 53b extend generally parallel to a length of the load beam (FIG. 4 and claim 8). Each outer panel is 53a, 53b is sandwiched between two piezoelectric elements 52a, 52c and 52b, 52d, respectively. The flexure 42 is attached to the deflectable portion of load beam 18 to attachment joints 54a, 54b, 54c by corresponding attachment joints 64a, 64b, 64c (FIGS. 4 and 5). The flexure 42 is positioned upon the load beam 18.

Kant et al. does not disclose, teach or suggest the structure recited in claim 2. As discussed and shown above in FIGS. 2, 4 and 5, the microactuator of Kant et al. is integrally formed in the deflectable portion of load beam. Furthermore, the outer panels of the deflectable portion extend generally parallel to the load beam. The flexure is attached by attachment joints 54a, 54b and 54c to the deflectable portion of the load beam at attachment joints 64a, 64b and 64c. The flexure is positioned upon the deflectable portion of the load beam. The microactuator of Kant et al. is formed as part of the load beam and operable to deflect the deflectable portion of the load beam to finely position the flexure attached to the deflectable portion. The microactuator of Kant et al. is comprised of two outer panels formed in the load beam and extending generally parallel along a length of the load beam. Each outer panel is sandwiched between piezoelectric elements on the top and bottom sides of the panel.

Claim 2 of the present application recites a bending motor attached to a flexible beam wherein the bending motor and the flexible beam are connected between a first section of the load beam and the flexure. The flexible beam and bending motor extend between the load beam and the flexure, as shown in FIG. 3 of the present application. The microactuator disclosed in Kant et al. does not teach, suggest or disclose the bending motor and flexible beam of claim 2. Neither the flexible beam nor the bending motor are integrally formed as part of the load beam and do not extend generally along the length of the load beam. Rather, both the flexible beam and the bending motor have one end attached to the load beam and one end attached to the flexure. The flexure is not attached directly to the flexible beam and is not positioned upon a portion of the load beam.

Kant et al. does not yield the present invention as defined by claim 2, thus the rejection of claim 2 under 35 U.S.C. § 102(e) should be withdrawn. Claims 3-6 depend from claim 2, therefore, the rejection of claims 3-6 should be withdrawn as well.

Kant et al. does not disclose, teach or suggest the structure recited in claim 13 of the present application. As discussed above with respect to claim 2 and shown in FIG. 4 of the Kant et al. patent, the outer panels 53a and 53b are integrally formed in the deflectable portion of the load beam and extend generally parallel along a length of the load beam. The piezoelectric elements are

attached to the outer panels. The flexure is attached to the deflectable portion of the load beam and is positioned upon the deflectable portion.

As required by claim 13, Kant et al. does not disclose a beam connected between the head suspension of the load beam and the flexure. In addition, the microactuator of Kant et al. is not attached to a top surface of a beam extending between the load beam and the flexure, but rather the microactuator is attached to a deflectable portion of the load beam. The flexure of Kant et al. is not attached to the outer panels 53a, 53b, but rather is attached to other deflectable portions of the load beam. Finally, the flexure of the present invention is not positioned upon the load beam. The beam of the present invention is not equivalent to the outer panels of the deflectable portion of the load beam of Kant et al. because the flexible beam is not formed in the load beam and does not extend generally parallel along a length of the load beam. Accordingly, the rejection of claim 13 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 1-3 and 6 are rejected under 35 U.S.C. § 102(e) as being anticipated by Hawwa et al. Hawwa et al. discloses a head flexure assembly for radially positioning a transducing head over a selected track of a rotatable disc in a disc drive system having an actuator arm and a flexure. The head flexure assembly is comprised of a bimorph piezoelectric microactuator having first and second ends, the microactuator being bendable in response to a control signal in a plane generally parallel to the rotatable disc. Specifically, Hawwa et al. teaches a head flexure assembly wherein the microactuator is attached between the actuator arm and the flexure for moving the flexure with respect to the actuator arm, i.e., there is no load beam. Swage flaps (45,47) attach the first end of the microactuator to the actuator arm and the second end of the microactuator to the flexure (seen in FIG. 2 below).

Hawwa et al. does not include a load beam in the disc drive system or head flexure assembly. In the head flexure assembly, when the microactuator is actuated to deflect the piezoelectric (PZT) layers and move the flexure, the tensile load is transferred through the PZT layers, which causes a bending moment in the PZT layers. The bending moment results in a loss of

robustness, and in particular, in the event of a shock event, the vertical load transfer will break the PZT layers (i.e., the microactuator).

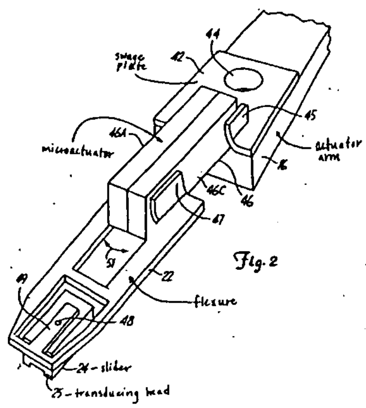

Fig. 2

In regards to claim 1, it is respectfully submitted that Hawwa et al. does not disclose the invention as claimed. Claim 1 recites a microactuator for selectively altering a position of a transducing head carried by a slider in a disc drive system with respect to a track of the rotatable disc having a plurality of concentric tracks. The microactuator includes means for flexibly coupling a stationary region of the load beam to a moving region of the load beam and means for selectively altering a position of the slider with respect to the rotatable disc. The means for selectively altering is mounted to the means for flexibly coupling and extends from the distal end of the stationary region to a proximal end of a moving region generally along a longitudinal center line of the stationary region.

Claim 1 contains two elements, both of which are set forth in means-plus-function form, as prescribed by 35 U.S.C. § 112, paragraph 6. Thus, the two elements must be interpreted as limited to the corresponding structure described in the specification and equivalence thereof. See MPEP 2181, citing *In re Donaldson Company*, 29 U.S.P.Q.2d (BNA) 1845 (Fed. Cir. 1994). The first element of claim 1 recites "means for flexibly coupling the stationary region of the load beam to the moving region of the load beam." The corresponding structure for this means is defined in the specification and drawings of the present application as a flexible beam, which connects the

stationary region of the load beam to the moving region of the load beam. The second element of claim 1 recites "means for selectively altering a position of the slider with respect to the rotatable disc, the means for selectively altering mounted to the means for flexibly coupling and the means for selectively altering extending from the distal end of the stationary region to a proximal end of the moving region generally along a longitudinal centerline of the stationary region." The corresponding structure for the means for selectively altering is defined in the specification and drawings of the present application as a bending motor mounted to the flexible beam.

The flexible beam is the structural element which connects the stationary region of the load beam to the moving region of the load beam, whereas the bending motor is the actuating element mounted to the flexible beam which extends from the stationary region to the moving region generally along a longitudinal center line of the stationary region. The bending motor operates as a bendable cantilever to alter the position of the moving region with respect to the stationary region and effect high resolution positioning of the transducing head.

In order for a prior art reference to anticipate claim 1, the reference must teach elements that perform the identical functions specified in the claim. In addition, the structure of the prior art elements must be the same as or equivalent to the structure described in the specification which correspond to the claimed means-plus-function. See MPEP 2182. Therefore, in order to anticipate claim 1, Kant et al. must disclose a structure which is the same as or equivalent to the present invention.

The office action states:

> "In the instance case, 1) the prior art reference to Hawwa et al performs the function specified in the claim (i.e. actuation); 2) the actuator of Hawwa et al is not excluded by any explicit definition provided in the instant specification for an equivalent; and 3) the actuator of Hawwa et al is an equivalent of the microactuator means set forth in claim 1 in that the prior art Hawwa et al performs the identical function specified in the claim (selectively altering a position of the slider with respect to the rotatable disc) in substantially the same way (microactuation) while producing the same results (micro positioning over the disc)."

The Examiner does not address how Hawwa et al. substantially discloses a prior art element which performs the same function as the means for flexibly coupling. Claim 1 requires that the means for selectively altering the bending motor is mounted to the means for flexibly coupling (the flexible beam). However, Hawwa et al. does not disclose the microactuator mounted to a flexible beam or a flexible beam which extends between and couples a stationary region of load beam to a moving region of the load beam. In addition, Hawwa et al. does not disclose a load beam as part of the head flexure assembly.

The prior art reference of Hawwa et al., in particular the microactuator element, performs the selectively altering function specified in claim 1 (i.e. that is actuation). However, the microactuator of Hawwa et al. is excluded by an explicit definition provided in the specification of the present application. In the present application, the bending motor is mounted to the flexible beam, and the flexible beam is connected between the stationary region of the load beam and the moving region of the load beam. First, Hawwa et al. does not disclose a load beam, rather the microactuator is connected between the actuator arm and the flexure. Second, the microactuator of Hawwa et al. is not mounted to a flexible beam extending between the actuator arm and the flexure.

In the present invention, the tensile load is transferred through the flexible beam and a force on the flexure is transformed to a compressive load on the bending motor (i.e., PZT layers). The PZT layers tend to withstand compressive loads much better than tensile loads. Thus, shock loads experienced by the slider create compressive loads in the bending motor, which is accomplished through the use of the flexible beam. The bend moment is converted into the compression force and the PZT layers absorb this compressive load. The microactuator of Hawwa et al. is not subjected to compressive loads because there is no flexible beam to absorb the tensile loads. The tensile load is transferred to the PZT layers in Hawwa et al., which results in a loss of robustness and degradation of the microactuator performance when the slider is exposed to shock loads during operation. (page 7-8, lines 7:9-8:3). Because the microactuator of Hawwa et al. lacks

a flexible beam, it is not subjected to compressive loads. Thus, the microactuator of Hawwa et al. is excluded by an explicit definition within the present application as an equivalent.

A comparison of the teachings of Hawwa et al. to the structure disclosed in the present application reveals differences between the microactuator of the present application and the head flexure assembly of Hawwa et al. and precludes a finding that the two systems are interchangeable or equivalent. As discussed above and shown in FIG. 2 of Hawwa et al., Hawwa et al. teaches a head flexure assembly wherein the microactuator is attached between the actuator arm and the flexure for moving the flexure with respect to the actuator arm. The microactuator of Hawwa et al. is not mounted to a flexible beam nor does the head flexure assembly or the disc drive system include a load beam, as required by claim 1 of the present application. Hawwa et al. does not disclose or teach a microactuator that moves a moving region of a load beam with respect to a stationary region of the load beam (as recited by claim 1 of the present application). The microactuator of Hawwa et al. shown in FIGS. 2-5 extends between an actuator and a flexure, not between a moving region and a stationary region of a load beam, as required by claim 1 of the present application. On the contrary, the head flexure assembly of Hawwa et al. does not include a load beam. A load beam provides an advantage in a head suspension by providing a complaint area which gives way to vertical movement of the disc.

In order for a prior art element to be equivalent to a means-plus-function limitation, the prior art element must perform the identical function specified in claim 1 in substantially the same way and produce substantially the same result as the means-plus-function limitation in claim 1. *Kemco Sales Inc. v. Control Papers Co., Inc.*, 208 F.3d 1352, 54 U.S.P.Q.2d 1308 (Fed. Cir. 2000). Hawwa et al. does not perform the stated function of the first element of claim 1, flexibly coupling the stationary region of the load beam to the moving region of the load beam. The office action states metal shim 46a of Hawwa et al. comprises means for flexibly coupling the stationary region of the load beam to the moving region of the load beam. However, such a characterization is inaccurate. Metal shim 46b forms a layer of the microactuator (col. 3, lines 55-57). Furthermore,

the metal shim does not flexibly couple portions of a load beam because Hawwa et al. does not include a load beam.

Hawwa et al. does not anticipate claim 1 and the rejection of claim 1 under 35 U.S.C. § 102(e) should accordingly be withdrawn.

Hawwa et al. does not disclose, teach or suggest the claimed invention disclosed in claim 2 of the present application. As discussed above, claim 2 recites a microactuator including a flexible beam and a bending motor connected between a first section of the load beam and the flexure. The bending motor is deformable in response to a control signal applied thereto and it attached to the flexible beam.

Hawwa et al. does not disclose a load beam attached to the actuator arm with a microactuator connected between the load beam and the flexure. Rather, Hawwa et al. teaches a head flexure assembly, not including a load beam, where the microactuator is connected between the actuator arm and a flexure (seen in FIG. 2 of Hawwa et al. above). The Examiner mischaracterizes Hawwa et al. by stating that the microactuator is comprised of a load beam attached to a distal end of the actuator arm. There is no load beam disclosed in Hawwa et al.

A comparison of the prior art disc drive actuation system shown in FIG. 1 of Hawwa et al. and the inventive system shown in FIG. 2 of Hawwa et al. shows that the microactuator replaces the head suspension 18, or load beam, known in the prior art. In the present invention disclosed by claim 2, a microactuator is added to the disc drive actuation system between the load beam and the flexure to move the flexure with respect to the load beam, rather than the load beam being replaced by a microactuator (as in Hawwa et al.). Thus, Hawwa et al. does not disclose, teach or suggest adding a bending motor between the load beam and the flexure, but rather teaches eliminating the load beam and including a microactuator between the actuator arm and the flexure.

Hawwa et al. does not yield the present invention as defined by claim 2, thus the rejection of claim 2 under 35 U.S.C. § 102(e) should be withdrawn.

Claim rejection-35 U.S.C. § 103(a)

Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Kant et al. in view of Fan et al. Claim 12 depends from claim 2, and therefore is allowable therewith. The rejection of claim 12 under 35 U.S.C. § 103(a) should accordingly be withdrawn. Furthermore, Kant et al. is assigned to Seagate Technology LLC, the same assignee as the present application. Since the present application was filed after November 29, 1999, the rejection is under 35 U.S.C. § 102(e)/103, and the inventions are commonly owned by Seagate Technology LLC, the rejection under 35 U.S.C. § 103(a) is precluded. See 35 U.S.C. §103(c) and MPEP 715.01(b).

Since the rejection of claims 2 and 13 should be withdrawn, claims 7-11 and 14-17 are no longer dependent upon rejected base claims and the objection to those claims should accordingly be withdrawn. Allowance of claims 1,2 and 4-17 is respectfully requested.

Respectfully submitted,

KINNEY & LANGE, P.A.

Date: 3/7/03

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APPENDIX:
MARKED UP VERSION OF SPECIFICATION AND CLAIM AMENDMENTS

1. (Amended) A microactuator for selectively altering a position of a transducing head carried by a slider in a disc drive system with respect to a track of a rotatable disc having a plurality of concentric tracks, the disc drive system having an actuator arm attached to a load beam for supporting the slider over the rotatable disc, the load beam having a stationary region and a moving region, the microactuator comprising:

means for flexibly coupling the stationary region of the load beam to the moving region of the load beam; and

means for selectively altering a position of the slider with respect to the rotatable disc, the means for selectively altering the position of the slider mounted to the means for flexibly coupling and the means for selectively altering the position of the slider extending from a distal end of the stationary region to a proximal end of the moving region generally along a longitudinal centerline of the stationary region.

2. (Amended) A microactuator for selectively altering a position of a transducing head carried by a slider in a disc drive system with respect to a track of a rotatable disc having a plurality of concentric tracks, the disc drive system having an actuator arm, the microactuator comprising:

a load beam attached to a distal end of the actuator arm, the load beam having a first section;

a flexure for supporting the slider carrying the transducing head; [and]

a bending motor attached between the first section of the load beam and the flexure, the bending motor being deformable in response to a control signal applied thereto[.]; and

a flexible beam connected between the first section of the load beam and the flexure wherein the bending motor is attached to the flexible beam.

3. (Canceled) The microactuator of claim 2 further comprising a flexible beam connected between the first section of the load beam and the flexure, and wherein the bending motor is attached to the flexible beam.

4. (Amended) The microactuator of claim [3] 2 wherein the bending motor is attached to a top surface of the flexible beam such that the flexible beam supports the bending motor and transforms a force on the flexure into a compressive load on the bending motor.

6. (Amended) The microactuator of claim 2 wherein the load beam has a second section connected to the flexure, and further wherein [a] the flexible beam is connected between the first section and the second section of the load beam [and the bending motor is attached to the flexible beam].